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(54) **Pneumatic tyres**

(57) A pneumatic tyre (10) having a pair of beads (15) each of which comprises a plurality of bundled together wire hoops (40), and a carcass ply (16) extending between the beads (15). The end portions (30) of the carcass ply are anchored in each bead bundle (15) by at least one hooped member (40), (22) or (23) incorporated in the bead configuration. The carcass ply (16) may be reinforced by a continuous cord formed as a series of windings looped around a pair of hooped support elements (22) or (23) which are incorporated into each bead (15) to occupy a position within the bead configuration.

Fig. 1.

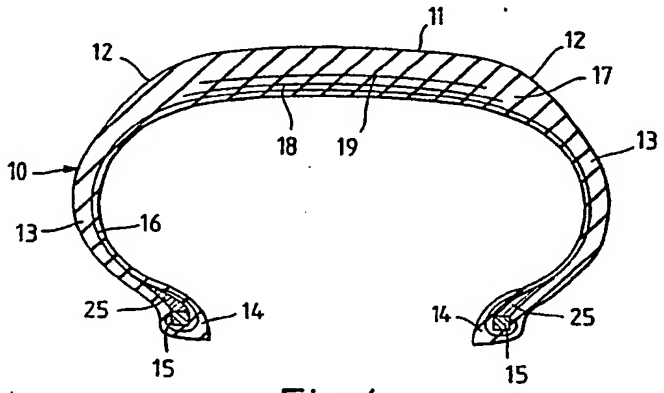

Fig. 4.

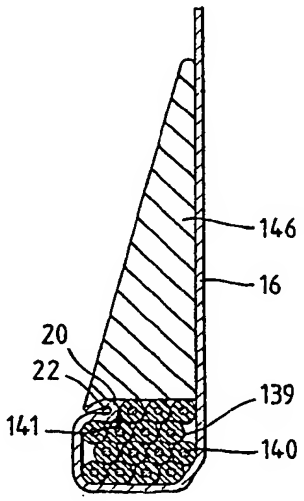

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Fig.1.

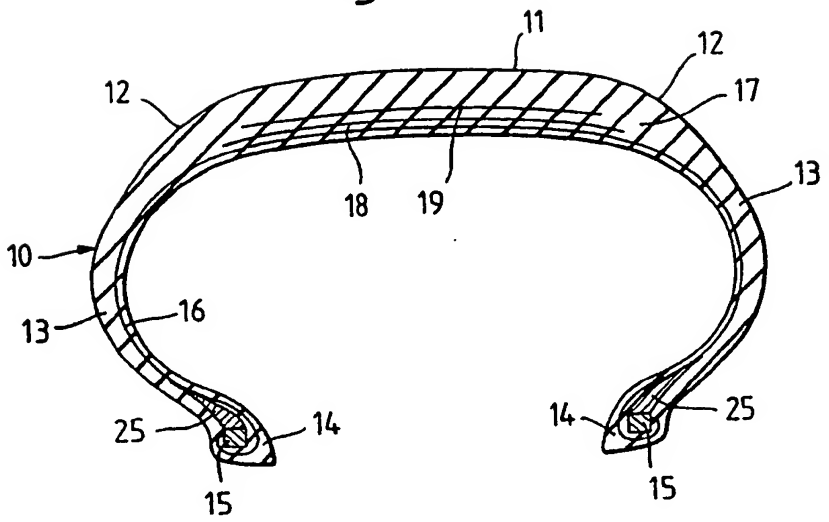

Fig.2.

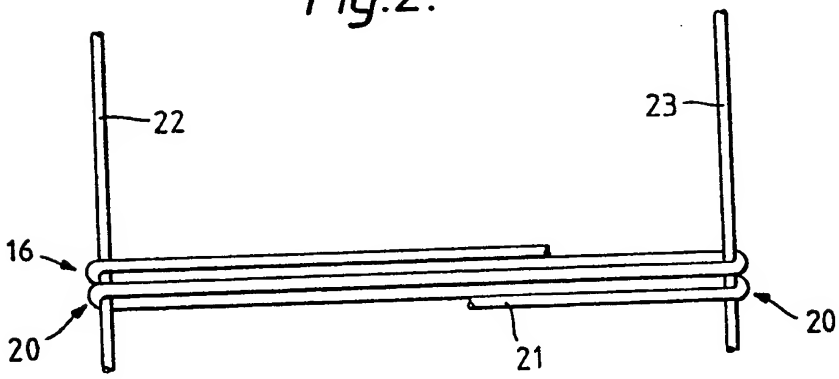

Fig.3.

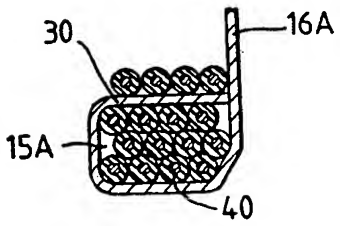

Fig.6.

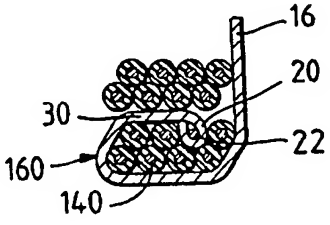

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Fig.4.

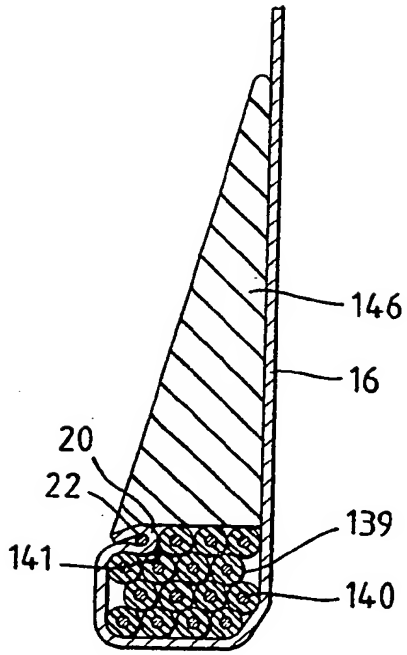
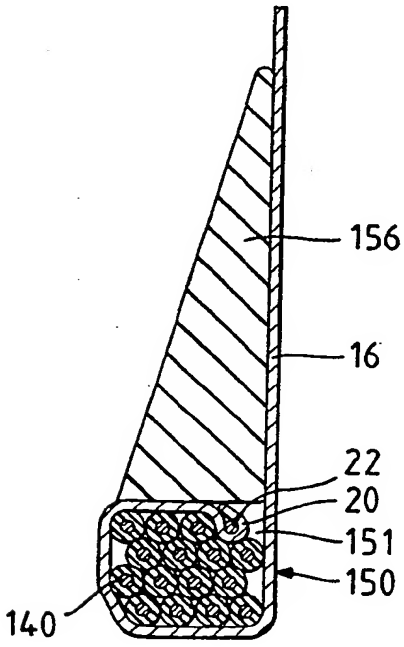


Fig.5.



SPECIFICATION

Pneumatic tyres

This invention relates to pneumatic tyres and in particular to radial construction penumatic tyres for automobiles.

A pneumatic tyre normally comprises a carcass ply of elastomeric material reinforced by substantially parallel cords which extend from one bead to the other beat of the tyre. These cords are typically made of polyester, nylons, aromatic polyamide, or steel wire. In a radial tyre the cords make a bias angle with the centre plane of the tyre of between 70° and 90°. The carcass reinforcement cords resist expansion of the tyre carcass under inflation pressures and it is therefore essential that the carcass is securely anchored at the tyre beads. In a conventional tyre the carcass ply passes axially on one side of each brad and is turned back on itself around the axially other side of each bead so that each bead is located in a looped portion of the carcass ply. In some tyres the turn-up portions of the carcass ply can extend for considerable distance radially outwardly of the beads for example up to the mid-sidewall of the tyre.

In other tyres, for example, as shown in British Patent GB 356290, or WO 83/02749, the carcass is formed by winding a continuous reinforcing cord in a series of side by side windings around a pair of spaced apart beads so that the beads are located within the looped end portions of the carcass reinforcement cord where the cord turns back on itself. The present invention provides an alternative means by which the carcass ply is anchored to the beads of the tyre.

According to the invention there is provided a pneumatic tyre having a pair of axially spaced annular beads each of which comprise a plurality of bundled together hoops of wire and a cord reinforced carcass ply extending between the annular beads wherein the respective ends of the carcass ply are anchored within each bead bundle by at least one hooped member incorporated in the bead configuration and holding said end in its respective bead.

Preferably the carcass ply is reinforced by a continuous cord formed as a series of windings looped around a pair of support elements, which are each in the form of a hoop, and wherein each support element is incorporated into each bead of bundled wire hoops so that it occupies a position within the normal bundled bead wire configuration.

The support elements may be wires which are inserted into a winding of carcass ply material of the type described in published U.K. Application No. 2159185, one wire being placed at each edge of a winding of cord passing around the wires and remaining in position as rubberised ply material is produced by the application of thin sheets of rubber to the upper and lower surfaces of the cord winding.

The finished plies consist of lengths of rubberised parallel cord fabric (which may conveniently be served from continuously produced fabric) in which the edge loops of the winding are retained by the wires.

When built into a tyre, a ply of the above kind may have its support wires circled and welded to form a hoop which is fitted within the bead wire configuration so as to anchor the loops of cord securely within the bead bundle.

Alternatively the wires can have a length several times that of the ply so that the wires can be formed into a plurality of circular turns and the portion of the wire passing through the edge loops of the ply also forms a complete single turn of the continuous turns, which are bundled to form the beads.

The invention will be described by way of example and with reference to the accompanying drawings in which:

Figure 1 is a schematic cross-section through a tyre according to this invention,

Figure 2 is a schematic drawing of a carcass ply reinforcement of the tyre used in the tyre shown in Figure 1,

Figure 3 is a detailed cross-sectional view of a carcass ply and bead wire assembly as can be used in the tyre of Figure 1,

Figure 4 is a detailed cross-section of a bead wire assembly as can be used in the tyre of Figure 1 with carcass ply as shown in Figure 2.

Figure 5 is a detailed cross-sectional view of a second bead wire assembly as is used with the cross ply of Figure 2.

Figure 6 is a detailed cross-sectional view of a third carcass ply and bead wire assembly also as is used with the carcass ply of Figure 2.

With reference to Figure 1, thee is illustrated a radial carcass tyre 10 intended for use on a passenger car. The tyre 10 has a ground contacting tread portion 11 having shoulder portions 12 on each axial side thereof. Sidewalls 13 extend radially inwardly from the shoulders 12 and terminate in bead portion 14 which are each reinforced by an annular bead 15, and an apex 24 radially outwardly of the bead.

The trye is reinforced by annular carcass ply 16 which extends from one bead 15 to the other bead 15, through the sidewalls 13 and under the tread 11. The tread portion 11 in its crown region is further reinforced by a breaker 17 comprising a pair of annular belts 18 and 19.

In a first embodiment of the invention, shown in Figure 3 the carcass ply 16A can be of conventional construction with the end portion 30 anchored within the bead 15A. The bead 15A is preferably, of a construction in which it is formed by winding a continuous steel wire cord 40 in a plurality of turns which are bundled together in a predetermined configuration, in this case substantially square, although it could be round or hexagonal or any other commonly used configuration. The end portion 30 of the carcass ply is anchored within the bead 15, as shown, or at some other suitable position within the configuration of the bead. Futhermore, the number of hooped turns in the bead wire, whilst shown as sixteen turns, in this example, will vary dependant upon the construction and end use of the tyre.

The carcass ply 16, however, is preferably, of the construction shown in Figure 2 in which a continuous reinforcing cord 21 is wound helically around a pair of axially spaced support members 22 and 23 which are preferably made of steel wire, so that the support members are located in the looped ends of portions of the chord 21 at the edges 20 of the ply 16.

With a carcass 16 as described above, then the tyre 10 in accordance with this invention, can have a bead construction as shown in Figure 4, Figure 5 and Figure 6.

With reference to Figure 4, the bead wire assembly 139 is formed from a four layer winding of inextensible rubberised steel cords 140. The cords 140 can be wound as a layer of four parallel cords in a flat strip, or as a plurality of turns or hoops of a continuous wire. An outer layer of cords, preferably the radially outer layer, has one winding of cord omitted to form a notch, or space 141, in the normal bead wire configuration on the axially outer side thereof. The support member 22 or 23 for the carcas ply 16 is fitted into the vacated position in the bead wire configuration so that the looped ends 20 of the ply 16 are anchored within the bead bundle by the wire support member 22 or 23. As described above the support members 22 and 23 may be formed as single complete wire hoops which may be unbroken, or broken as desired, or alternatively if the bead wire assembly 139 comprises a plurality of bundled together turns of continuous wire, the support element may be constituted by a single turn of the continuous wire. A rubber apex strip 146 is positioned on the bead 140 radially outwardly thereof.

Figure 5 shows an alternative construction in which a bead wire assembly 150 is formed with a notch 151 on its axially inner side for reception of the ply edge 20 and support wire 22 or 23, the ply 16 making a full turn around the assembly. An apex 156 is fitted radially outwardly of the bead wire assembly 151.

With reference to Figure 6, there is shown yet another embodiment of the invention, the support member 22 or 23 is encased in the centre of the bead bundle 160 during the manufacture of the bead assembly. In this example a particular position within the bead wire is illustrated as the location of the support member 22 or 23. It will be appreciated that other positions within the bead wire configuration are equally suitable.

The function of the support wire elements 22 or 23 in the examples described above is to anchor the ply edges 20 to the bead wire assemblies both during building and in the finalised tyre. The support elements in Figure 4 and Figure 5 can be secured in position on the sides of the bead bundles 140, 150, by any suitable means, e.g. the green adhesive strength of the rubber coating on the wire, brazing, surrounding the bead bundles with cord to hold it together. This feature is important in the finished tyre, but after vulcanisation of the surrounding rubber less strength is required in the mechanical lock provided by the wire support element since adhesion of the ply cords to the surrounding rubber then provides a firmer anchorage. Before vulcanisation, and particularly during shaping of the carcass to toroidal form, the wire support elements positively resist displacement of the ply edges under the tension set up in the ply cords. Provided that adequate support can be provided by bead clamps during shaping, it may therefore be possible to use support elements other than complete (e.g. welded) wire support rings: the wires may simply be circled and overlapped without the ends being directly secured together by welding, or may be replaced by relatively weaker support elements such as plastics or textile cords or filaments. In such alternatives greater reliance would be placed on the vulcanisation of the surrounding rubber to maintain integrity of the support element in the finished tyre.

Tyres made in accordance with the invention as described above have the advantage that less ply cord material is used than in conventional tyres, because of the elimination of the ply turn-ups. Positively anchored ply edges, together with accurately located bead wire assemblies will also provide greater uniformity in performance.

Whilst the invention has been described with reference to the examples shown in the drawings it will be appreciated that the man skilled in the art can make minor modifications and alterations without departing from the scope and spirit of the invention, for example, the bead bundles could be formed in alternative ways.

CLAIMS

1. A pneumatic tyre having a pair of axially spaced annular beads each of which comprises a plurality of bundled together hoops of wire, and a cord reinforced carcass ply extending between the annular beads wherein the respective ends of the carcass ply are anchored within each bead bundle by at least one hooped member incorporated in the bead configuration and holding said end in its respective bead.

2. A pneumatic tyre as claimed in Claim 1 wherein the carcass ply is reinforced by a continuous cord formed as a series of windings looped around a pair of support elements, which are each in the form of a hoop, and wherein each support element is incorporated into each bead of bundled wire hoops so that it occupies a position within the normal bundled bead wire configuration.

3. A pneumatic tyre as claimed in Claim 2 wherein each support element is in the form of a complete hoop.

4. A pneumatic tyre as claimed in Claim 3 wherein the support elements are each formed as a continuous unbroken ring of wire.

5. A pneumatic tyre as claimed in Claim 2 wherein each bead comprises a plurality of bundled together turns of a continuous wire and said support element is constituted by a single turn of the continuous wire.

6. A pneumatic tyre as claimed in Claim 3, Claim 4 or Claim 5 wherein the support elements are anchored in position in an outer layer of the respective bead bundle.

7. A pneumatic tyre as claimed in Claim 6 wherein the support elements are located on the axially outer side of each bead wire configuration.

8. A pneumatic tyre as claimed in Claim 6 wherein the support elements are located on the axially inner side of each bead wire configuration.

9. A pneumatic tyre substantially as descried herein and with reference to any one of Figures 3, 4, 5 and 6 of the accompanying drawings.

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